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Comparing Lecture and E-Learning as Learning Process in Mathematics and Statistics Courses for Engineering Students in Universiti Kebangsaan Malaysia

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Abstract

In order to be parallel with young generations in terms of technology, e-learning was introduced to engineering students in FKAB. With the hope that e-learning is a way to enhance learning in a more convenient and cost-effective manner, on the other hand the traditional method as lecturing is still of use until now. This study examines students' perception towards the importance and usefulness of modern technologies such as e-learning (WILEY PLUS) in comparison with the more traditional lecture, as knowledge delivery or alternatively, a method of learning process. The objectives of this study are to test whether there is any difference between these two methods and to identify which method is more important and agreeable to the students. The sample of this study consists of First Year and Second Year engineering students at the Faculty of Engineering and Built Environment, UKM who have taken Mathematics and Statistics courses respectively. The paired t-test was used to compare these two methods. This study reveals that there is a significant difference between WILEY PLUS and lecturing in Mathematics and Statistics courses. Overall, lecturing was significantly of importance and favourable in the learning process for both courses compared to the newly-introduced WILEY PLUS.

Keywords : e-learning; WILEY PLUS; lecturing; likert scale; paired t-test

1. Introduction

In the Faculty of Engineering and Built Environment (FKAB), Universiti Kebangsaan Malaysia (UKM), the first year engineering students are required to take Mathematics (Linear Algebra) while the second year students are

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required to take Statistics course. The methods of learning used for both courses are the traditional lecture delivery and modern technology-based approach such as e-learning.

Traditional lecture delivery or lecturing is a common strategy method of learning process at the tertiary level. There are many definitions of lecturing persistent in the context of further education. Middendorf and Kalish (1996) define that lecturing is when lecturer talks and writes something on the board, while the students listen and take copious notes of what are being written on the board (Ghani, 2009). McIntosch (1996) defines that lecturing is a one-way verbal communication unaccompanied by discussion, questioning or immediate practice.

In modern technology nowadays, e-learning has been developed to become a new method of learning. Many institutions use this technology to improve the students' performance as well as lecturers (Tawil et al. 2011). E-learning is defined as information and communication technologies; a network, including the use of the Internet and the World Wide Web; delivery on time, at any time; and an electronic exchange of information for the purpose of learning. Berge and Collins (1995) define an E-Learning as an educational setting, in which teaching and learning take place within an internet-based environment .

In FKAB, both courses use the WILEY PLUS as an e-learning method. WILEY PLUS is a web-based application that assists lecturers in preparing for classes and lectures and automates the processes of assigning and grading homework (Razali et al. 2011). It allows students to complete their homework online and receive instant feedback on their work. There are three main components in Wiley Plus i.e. Read, Study and Practice, Assignments and Gradebook. Read, Study and Practice constitute an area for self-guided student activities. It contains full online texts and may also include other study materials to help students learn about the subject. The Assignment tab is where students navigate to see all of their assignments with their given due dates. Assignments can be either in the form of scored questions or unscored tasks such as readings, animations or practice problems. Gradebook allows students to view all their scores from the assignments in their class. It also allows lecturers to view all the students' scores for each assignment. Usually, lecturers will assign them to do the assignment using WILEY PLUS after they have finished learning a chapter (Tawil et al. 2010).

In comparing between these two methods, we are interested to test if differences exist between these two methods and to identify which method is more important and agreeable or favourable to the students.

2. Methodology

A random sample of 100 students was taken from First Year and Second Year Engineering students. A set of questionnaire was given to them which comprised the profile of the students and the questions about the e-learning and lecturing methods.

In this study, we are focusing only on the students' perception towards the importance and usefulness of WILEY PLUS and lecturing in their courses. The five-point Likert scale data were used to these questions whereby 1-strongly disagree, 2- disagree, 3- not sure, 4-agree, 5-strongly agree. There are two statements which serve to represent these questions, which are:

Statement 1: The explanations for each topic in Statistics/Mathematics course are clearly explained,
Statement 2: Notes and Assignment provided assistance in understanding those topics.

Students are required to answer these two statements using the scale, regarding the importance and the extent of their agreeability towards these statements.

There are many controversial issues that emerging when analyzing the Likert scales data. The Likert scale data can be assumed as ordinal or interval, depending on how the researcher judges it (Jamieson, 2004 and Knapp, 1990). Here, because the Likert scales is assumed to have equal distance between each value, it is assumed as interval data. Since the data are assumed as interval, the parametric test should be used. To ascertain the validation of this parametric test, the normality assumption should be put to the test. In this study, since the sample size was rather large, the normality assumption had been satisfied. The parametric tests which involved the paired t-test will be discussed later.

In the analysis part, the descriptive and inferential statistics were used. A mean and standard deviation were used as descriptive statistics, and a paired t-test (parametric test) was used as inferential statistics. There are two hypotheses that are established as the following:

H_0: There is no significant difference between WILEY PLUS and lecturing methods in Mathematics/Statistics
H_1: There is a significant difference between WILEY PLUS and lecturing methods in Mathematics/Statistics

The results of the paired t-test like the two tailed p-value and 95% confidence interval for the upper bound and lower bound were then discussed. If the p-value is lower than 5% level of significance, H_0 will then be rejected. Same results are also confirmed if the mean difference lies between the upper and lower bounds of 95% confidence interval.

3. Results and Analysis

In the analysis part, two types of statistics were considered. One is the descriptive statistics and the other one is the inferential statistics.

3.1. Descriptive statistics

A descriptive analysis consisting of mean and standard deviations for each statement was calculated and highlighted in Table 1 and Table 2 for Mathematics and Statistics respectively.

Table 1. Mean and standard deviations for each statement in Mathematics

	Descriptive	**Wiley Plus**	**Lecturing**		**Descriptive**	**Wiley Plus**	**Lecturing**
Statement 1: The explanations for each topic in Mathematics course are clearly explained.							
Importance	Mean	3.72	4.59	*Agreeable*	Mean	3.72	4.52
	Standard deviation	0.96	0.81		Standard deviation	0.96	0.86
Statement 2: Notes and Assignment provide assistance in understanding those topics.							
Importance	Mean	3.88	4.57	*Agreeable*	Mean	3.86	4.62
	Standard deviation	0.96	0.86		Standard deviation	0.96	0.81

Table 2. Mean and standard deviations for each statement in Statistics

	Descriptive	**Wiley Plus**	**Lecturing**		**Descriptive**	**Wiley Plus**	**Lecturing**
Statement 1: The explanations for each topic in Statistics course are clearly explained.							
Importance	Mean	2.82	4.65	*Agreeable*	Mean	2.81	4.62
	Standard deviation	1.12	0.74		Standard deviation	1.22	0.76
Statement 2: Notes and Assignment provide assistance in understanding those topics.							
Importance	Mean	2.98	4.65	*Agreeable*	Mean	3.03	4.58
	Standard deviation	1.18	0.77		Standard deviation	1.20	0.81

As indicated in the column 'lecturing' of Table 1, the results of mean are almost 5 and the standard deviation values are less than one. On the five-point Likert scale, these values lie between "agree" and "strongly agree". Meanwhile, in the column of WILEY PLUS, the results of mean are almost 4 and standard deviation is less than one. The values of means for WILEY PLUS lie between "not sure" and agree".

Table 2 shows that in the lecturing column, the results of mean are almost 5 and the standard deviation values are less than one. These values lie between "agree" and "strongly agree". By contrast, in the WILEY PLUS column, the results of mean are almost 3 and standard deviation is greater than one which indicates that students are not sure of the importance and the agreeability towards both statements.

Overall, in comparing the mean and standard deviations of students' perception towards WILEY PLUS and lecturing in Mathematics and Statistics courses, the mean values for lecturing are greater than WILEY PLUS. Therefore, it can be concluded that lecturing is more important and agreeable to the students for each topic in Statistics and Mathematics courses. The values of standard deviation for lecturing are less than WILEY PLUS, which also concludes the same results as the values of mean. In order to make these results valid, an inferential statistics was then conducted and the results discussed in the next section.

3.2. Inferential statistics

A paired t-test for Mathematics and Statistics courses was calculated as displayed in Table 3 and Table 4 respectively.

Table 3. Results of the paired t-test for differences in the mean of WILEY PLUS and lecturing in Mathematics course.

		t	df	Sig (2-tailed)	Mean Difference	Std-Error Difference	95% Confidence Interval of the Difference	
							Lower	Upper
Pair 1	A-B	-6.95	99	0.00	-0.87	0.13	-1.12	-0.62
Pair 2	C-D	-6.25	99	0.00	-0.80	0.13	-1.05	-0.55
Pair 3	E-F	-5.47	99	0.00	-0.69	0.13	-0.94	-0.44
Pair 4	G-H	-6.58	99	0.00	-0.76	0.12	-0.99	-0.53

Notes: A: Students' perception towards the importance of WILEY PLUS for statement 1

B: Students' perception towards the importance of lecturing for statement 1

C: Students' perception towards the agreeability for WILEY PLUS for statement 1

D: Students' perception towards the agreeability for lecturing for statement 1

E: Students' perception towards the importance of WILEY PLUS for statement 2

F: Students' perception towards the importance of lecturing for statement 2

G: Students' perception towards the agreeability for WILEY PLUS for statement 2

H: Students's perception towards the agreeability for lecturing for statement 2

Table 3 displays the results of the paired t-test for differences in the mean of WILEY PLUS and lecturing in Mathematics course. The results of the two-tailed p-value of 0.00 for all pairs are less than the significant level of 0.05. H_0 can, therefore, be rejected and indicates that there is no significant two-tailed difference in the means of WILEY PLUS and lecturing in Mathematics course for all pairs. The same results appear where the mean difference for all pair lies between 95% confidence interval upper and lower bounds of the difference as stated in the last column in Table 3. The negative values of the mean difference for all pairs suggest that lecturing is more important and agreeable to the students compared to WILEY PLUS for both statements.

Table 4. Results of the paired t-test for differences in the means of WILEY PLUS and lecturing in Statistics.

		t	df	Sig (2-tailed)	Mean Difference	Std-Error Difference	95% Confidence Interval of the Difference	
							Lower	Upper
Pair 1	A-B	-12.94	99	0.00	-1.83	0.14	-2.11	-1.55
Pair 2	C-D	-13.02	99	0.00	-1.81	0.14	-2.09	-1.53
Pair 3	E-F	-11.69	99	0.00	-1.67	0.14	-1.95	-1.39
Pair 4	G-H	-10.88	99	0.00	-1.55	0.14	-1.83	-1.27

Notes: A: Students's perception towards the importance of WILEY PLUS for statement 1

B: Students's perception towards the importance of lecturing for statement 1

C: Students's perception towards the agreeability for WILEY PLUS for statement 1

D: Students's perception towards the agreeability for lecturing for statement 1

E: Students's perception towards the importance of WILEY PLUS for statement 2

F: Students's perception towards the importance of lecturing for statement 2

G: Students's perception towards the agreeability for WILEY PLUS for statement 2

H: Students's perception towards the agreeability for lecturing for statement 2

Table 4 displays the results of the paired t-test for differences in the means of WILEY PLUS and lecturing in Statistics. The results of the two-tailed p-value of 0.00 for all pairs are less than the significant level of 0.05. H_0 can, therefore, be rejected and indicates that there is no significant two-tailed difference in the means of WILEY PLUS and lecturing in Statistics course for all pairs. The same results appear where the mean difference for all pairs lies between 95% confidence interval upper and lower bounds of the difference as stated in the last column in Table 4. The negative values of the mean difference for all pairs indicate that lecturing is more important and agreeable to the students compared to WILEY PLUS, for both statements.

The results tandem with previous study where lecturing is found to be better than e-learning for trainees in dentistry (Browne et al., 2004). Razali et al. (2010) suggests that, WILEY PLUS should be improved in order to attract students in using this application- improvement of which, may include adding tool for mathematical equations and symbols, and including other information from other sources.

4. Conclusions

This study examines students' perception towards the importance and agreeability of modern technologies by drawing in comparison the WILEY PLUS and traditional lecture delivery as two tried-and-tested methods of the learning process. In both courses, the results of descriptive and inferential statistics indicate that lecturing is more important and agreeable to the students for the delivery of each topic in Statistics and Mathematics courses in a way that the explanation about each topic was clearly provided, and all notes and assignment provided by lecturer had assisted them in the understanding of those topics. It is recommended that for further analysis, other factors should also be investigated to find out the weaknesses of the e-learning.

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